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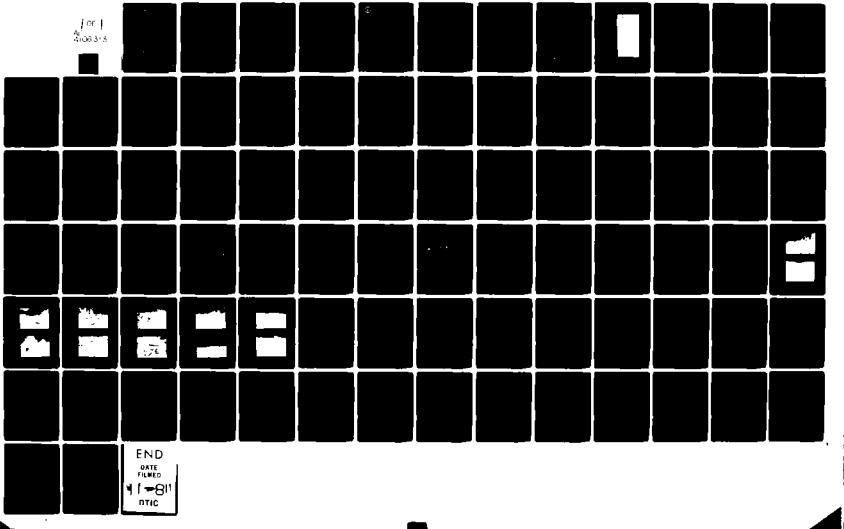

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BRANNEKY LAKE DAM
ST. LOUIS COUNTY, MISSOURI
MO. 31393

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
Serving the Army
Serving the Nation

St. Louis District

PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

MAY 1981

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dam Safety, Lake, Dam Inspection, Private Dams	
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.	

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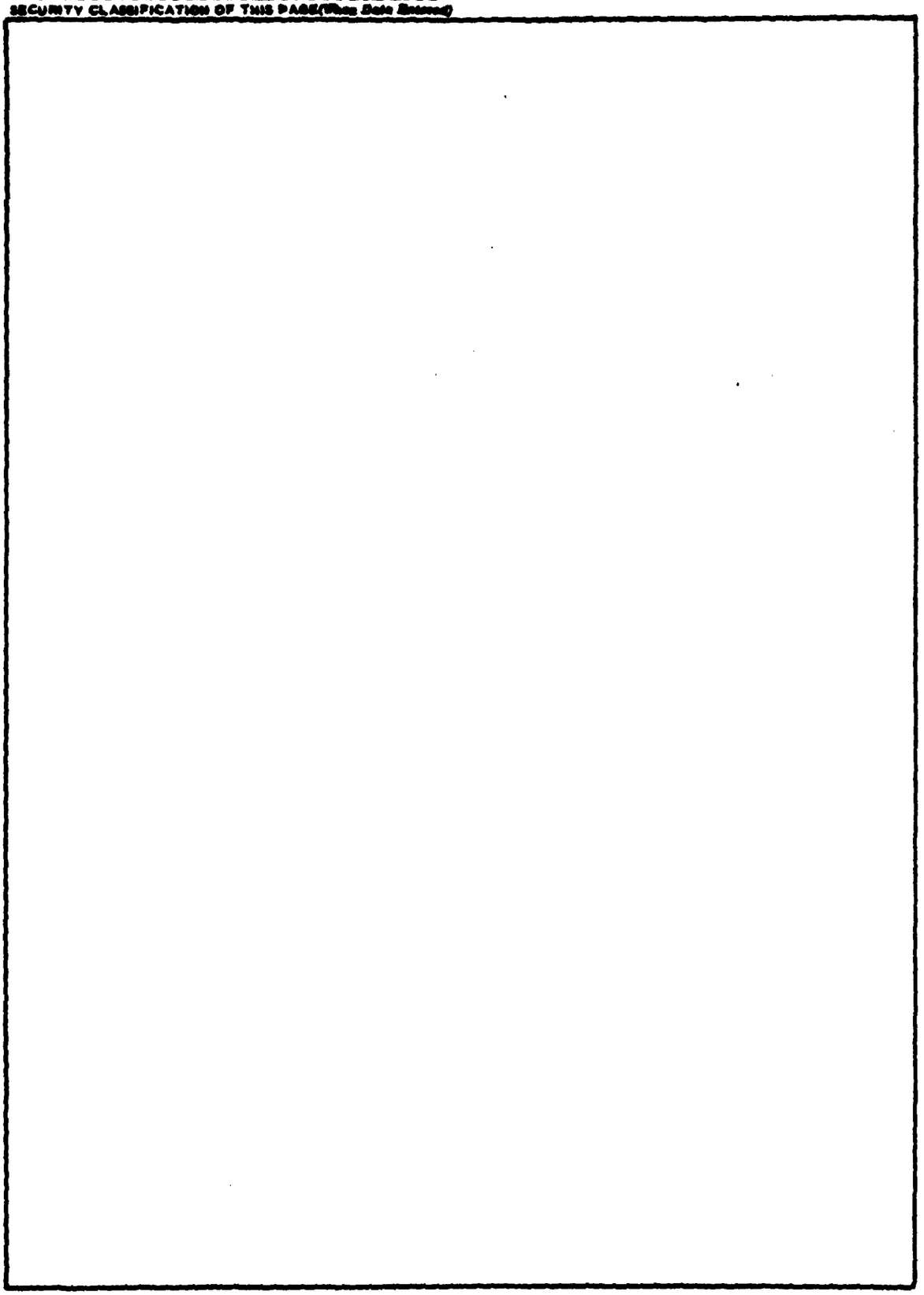

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

SUBJECT: Branneky Lake Dam (Mo. 31393) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Branneky Lake Dam (Mo. 31393).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, emergency by the St. Louis District as a result of the application of the following criteria:

1) The spillway will not pass a 10-year frequency flood without overtopping of the dam. The spillway is, therefore, considered to be unusually small and seriously inadequate.

2) Overtopping of the dam could result in dam failure.

3) Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED — 8 JUN 1981
Chief, Engineering Division — Date

APPROVED BY: SIGNED — 11 JUN 1981
Colonel, CE, District Engineer — Date

A

BRANNEKY LAKE DAM
ST. LOUIS COUNTY, MISSOURI

MISSOURI INVENTORY NO. 31393

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
PRC CONSOER TOWNSEND, INC.
ST. LOUIS, MISSOURI
AND
PRC ENGINEERING CONSULTANTS, INC.
ENGLEWOOD, COLORADO
A JOINT VENTURE

UNDER DIRECTION OF
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
FOR
GOVERNOR OF MISSOURI

MAY 1981

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Branneky Lake Dam,
Missouri Inventory No. 31393
State Located: Missouri
County Located: St. Louis
Stream: Unnamed tributary of the Missouri River
Date of Inspection: March 3, 1981

Assessment of General Condition

Branneky Lake Dam was inspected by the engineering firms of PRC Consoer Townsend, Inc. of St. Louis, Missouri, and PRC Engineering Consultants, Inc. of Englewood, Colorado (A Joint Venture) in accordance with the U. S. Army Corps of Engineers "Recommended Guidelines for Safety Inspection of Dams" and additional guidelines furnished by the St. Louis District of the Corps of Engineers. Based upon the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. Located within the estimated damage zone of one mile downstream of the dam are four dwellings, one building, and an interstate highway, which may be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Branneky Lake Dam is in the small size classification since it is 33.6 feet high and impounds 46 acre-feet of water.

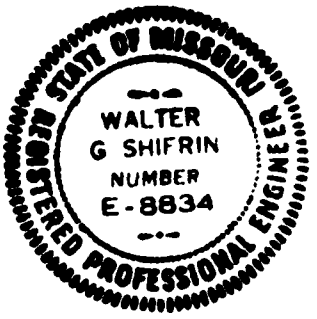
The inspection and evaluation of the consultant's inspection team indicate that the spillway of Branneky Lake Dam does not meet the criteria set forth in the guidelines for a dam having the above size and

hazard potential. Branneky Lake Dam being a small size dam with a high hazard potential is required by the guidelines to pass from one-half of the Probable Maximum Flood to the Probable Maximum Flood without overtopping the dam. Considering the small drainage area, the small storage capacity of the reservoir, the height of the dam, and the small number of dwellings in the downstream hazard zone, one-half of the Probable Maximum Flood is considered the appropriate spillway design flood for Branneky Lake Dam. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region. It was determined that the reservoir can store approximately 5 percent of the Probable Maximum Flood without overtopping the dam. The evaluation also indicates that the reservoir cannot accommodate the ten-percent chance flood without overtopping the the dam.

The overall condition of the dam appears to be fair; however, the severe obstruction of the corrugated metal pipe in the spillway jeopardizes the safety of the dam. Other deficiencies, noted by the inspection team, included: an area of standing water observed at the toe of the dam indicating possible seepage through the embankment; obstructions in the approach and discharge channels of the spillway; the erosion due to wave action, trees and animal burrows observed on the upstream slope; a need exists for periodic inspection by a qualified engineer; and there also exists a lack of maintenance and a maintenance schedule. The lack of seepage and stability analyses on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct or control the deficiencies described above.

Walter G. Shifrin, P.E.



Overview of Branneky Lake Dam

NATIONAL DAM SAFETY PROGRAM

BRANNEKY LAKE DAM, I.D. No. 31393

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

BRANNEKY LAKE DAM, Missouri Inv. No. 31393

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for Branneky Lake Dam was carried out under Contract DACW 43-80-C-0094 between the Department of the Army, St. Louis District, Corps of Engineers, and the engineering firms of PRC Consoer Townsend, Inc., of St. Louis, Missouri and PRC Engineering Consultants, Inc., of Englewood, Colorado (A Joint Venture).

b. Purpose of Inspection

The visual inspection of Branneky Lake Dam was made on March 3, 1981. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project, presents a summary of visual observations made during the field inspection, presents an assessment of hydrologic and hydraulic conditions at the site, and of the structural adequacy

of the various project features and assesses the general condition of the dam with respect to safety.

Subsurface investigations, laboratory testing and detailed analyses were not within the scope of this study. No warranty as to the absolute safety of the project features is implied by the conclusions presented in this report.

It should be noted that in this report reference to left or right abutments is viewed as looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to the northwest abutment or side, and right to the southeast abutment or side.

d. Evaluation Criteria

The inspection and evaluation of the dam is performed in accordance with the U.S. Army Corps of Engineers "Recommended Guidelines for Safety Inspection of Dams" and additional guidelines furnished by the St. Louis District office of the Corps of Engineers for Phase I Dam Inspection.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The following description is based upon observations and measurements made during the visual inspection and conversations with Mr. Henry Branneky, the original owner of the dam. No design or "as-built" drawings for the dam or appurtenant structures were available.

The dam is a homogeneous, rolled, earthfill structure, according to Mr. Branneky. The alignment of the dam is straight between earth abutments. A plan and elevation of the dam are shown on Plate 3 and Photos 1 through 3 show views of the dam. The dam

has a length of 440 feet and an assumed minimum top of dam elevation of 508 feet above mean sea level (M.S.L.). The top of dam was surveyed to be level between two points 100 feet and 140 feet from the right and left abutments, respectively. From the point 100 feet to the left of the right abutment, the top of dam slopes upward to the end of the dam with a rise in elevation of 1.3 feet. From the point 140 feet to the right of the left abutment, the top of dam slopes upward to the abutment contact with a rise in elevation of 1.1 feet. The embankment has a top width of 46 feet and a downstream slope of 1 vertical to 3.75 horizontal (1V to 3.75H). The upstream slope was measured to be near vertical for the first two feet below the top of dam and then 1V to 6H to the water surface on the day of the inspection. The maximum structural height of the dam was measured to be 33.6 feet.

The only spillway at this damsite consists of grasslined approach and discharge channels cut into the right abutment and a 24-inch diameter, corrugated metal pipe, control section. At the inlet of the approach channel is a welded wire screen one foot high and four feet long supported by a wooden frame (see Photo 5). The approach channel leads to the corrugated metal pipe (CMP) which passes under the road that extends across the top of the dam (see Photo 6). The CMP discharges into the discharge channel that extends approximately 100 feet downstream from the axis of the dam to where it enters the apparant downstream channel (see Photo 9). The spillway lies in a direction almost perpendicular to the axis of the dam. The earthcut channels are trapezoidal in shape with an average bottom width of ten feet and 1V to 2.5H side slopes. The spillway crest elevation was measured to be at 506.5 feet above M.S.L.

No low-level outlet or outlet works were provided for this dam.

b. Location

Branneky Lake Dam is located in St. Louis County in the State of Missouri on an unnamed tributary of the Missouri River. The dam is located approximately 0.6 mile to the northwest of the intersection of Interstates 70 and 270 and 3 miles southeast of St. Charles, Missouri, in Survey No. 282, Township 46 North, Range 5 East as shown on the St. Charles and Creve Coeur, Missouri Quadrangle (7.5 minute series) sheets. The axis of the dam is situated parallel to and approximately 900 feet southwest of Interstate 70.

c. Size Classification

The maximum structural height of the dam is less than 40 feet and greater than 25 feet, which classifies it as a "small" size dam. The maximum reservoir impoundment of Branneky Lake Dam is less than 50 acre-feet, which is the minimum storage requirement for a structure to be classified as a dam. Nevertheless, the size classification is determined by either the storage or height, whichever gives the larger size category. Therefore, the size classification is determined to fall within the "small" category, according to the "Recommended Guidelines for Safety Inspection of Dams" by the U.S. Department of the Army, Office of the Chief Engineer.

d. Hazard Classification

The dam has been classified as having a "high" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam, excessive damage could occur to downstream property, together with the possibility of the loss of life. From a visual inspection of the downstream area, our findings concur with this classification. Located within the estimated damage zone, which extends approximately one mile downstream of the dam, are four dwellings, one building (Boise-Cascade Plant) and an interstate highway (I-70) (see Photos 11 and 12).

e. Ownership

A property line divides Branneky Lake Dam into two property parcels. According to a recent survey by Fred Weber, Inc., approximately one-third of the dam is owned by Fred Weber, Inc. and the western two-thirds of the dam is owned by the Pillsbury Foundation. The mailing addresses are as follows: Fred Weber, Inc., c/o Mr. Bill Powell, 7929 Alabama Avenue, St. Louis, Missouri, 63111 and Pillsbury Foundation, c/o Mr. J.S. Pillsbury, #6 Oakleigh Lane, St. Louis, Missouri, 63124.

f. Purpose of Dam

According to Mr. Ken Kaiser of Fred Weber, Inc., the dam was built to store water for use in fighting potential fires at the Boise-Cascade Plant, located just downstream of the dam.

g. Design and Construction History

Mr. Henry Branneky, the previous owner of Branneky Lake Dam, said that the dam was built about 12 to 15 years ago by Bangert Brothers Construction Company of St. Louis, Missouri. The Bangert Brothers Construction Company was developing an industrial site just downstream of the dam at the time the dam was built. Mr. Branneky was also not aware of any drawings or specifications for the dam. It is unknown who did the actual engineering design of the dam.

h. Normal Operational Procedures

Normal procedure at the Branneky Lake Dam is to allow the reservoir to remain as full as possible. The water level is controlled by rainfall, runoff, evaporation, and the elevation of the spillway crest.

1.3 Pertinent Data

a. Drainage Area (square miles): . . 0.14

b. Discharge at Damsite

Estimated experienced maximum flood (cfs):. . . .	Unknown
Estimated ungated spillway capacity with reservoir at top of dam elevation (cfs):.	1.5

c. Elevation (Feet above MSL)

Top of dam:	508.0 (assumed)*
Spillway crest:	506.5
Normal Pool:.	505.5 (Evidence of Past Water Level)
Maximum Experienced Pool:	Unknown
Observed Pool:.	503.4

d. Reservoir

Length of pool with water surface at top of dam elevation (feet):	1200

e. Storage (Acre-Feet)

Top of dam:	46
Spillway crest:	34
Normal Pool:.	28
Maximum Experienced Pool:	Unknown
Observed Pool:.	19

f. Reservoir Surfaces (Acres)

Top of dam:	8.5
Spillway crest:	7.0
Normal Pool:.	6.5
Maximum Experienced Pool:	Unknown
Observed Pool:.	5.0

g. Dam

Type:	Rolled, Earthfill
Length:	440 feet
Structural Height:	33.6 feet
Hydraulic Height**:	33.6 feet
Top width:	46 feet
Side slopes:	
Downstream	1V to 3.75H
Upstream	Varies, near vertical for the top two feet and 1V to 6H to the water surface.
Zoning:	N.A., Homogeneous
Impervious core:	None
Cutoff:	None
Grout curtain:	Unknown
Volume:	58,100 cu. yds. (Estimated)

h. Diversion and Regulating Tunnel . . . None

i. Spillway

Type:	Earthcut channel with a 24-inch diameter corrugated metal pipe as the control section.
Length of crest:	N.A.
Crest Elevation (feet above MSL):	506.5

j. Regulating Outlets . . . . . None

* No exact elevation is known for the top of dam, therefore, an elevation was estimated from the St. Charles, Missouri, U.S.G.S. Quadrangle sheet. This estimated elevation is referred to as assumed elevation.

All other elevations were determined from the assumed top of dam elevation and field measurements.

** The hydraulic height of the dam is the vertical distance from the lowest point on the downstream toe to the top of dam or the maximum water surface, if below the top of dam.

SECTION 2: ENGINEERING DATA

2.1 Design

No design drawings, "as-built" drawings or calculations were available for Branneky Lake Dam.

2.2 Construction

No data are available concerning the construction of the dam and appurtenant structures. The following information about the construction of the dam was obtained from conversations with Mr. Henry Branneky. The dam was built using a dragline and bulldozers. The dragline removed the embankment material from the lakebed and placed it on the fill. The activity of the bulldozers across the fill compacted the embankment material. No compaction control was employed and no cutoff trench was excavated for the embankment.

2.3 Operation

No operational records for this dam were available to the inspection team.

2.4 Evaluation

a. Availability

The availability of engineering data is poor and consists only of State Geological Maps, a general soil map of the State of Missouri published by the Soil Conservation Service, and U.S.G.S. Quadrangle Sheets.

b. Adequacy

The conclusions presented in this report are based on field measurements, the available engineering data, past performance and present condition of the dam. The available data, including the field measurements taken by the field inspection team, are considered adequate to evaluate the hydraulic and hydrologic capabilities of the dam. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity

No valid engineering data pertaining to the design or construction of the dam were available.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of the Branneky Lake Dam was made on March 3, 1981. The following persons were present during the inspection:

Name	Affiliation	Disciplines
Mark Haynes, P.E.	PRC Engineering Consultants, Inc.	Soils
Jerry Kenny	PRC Engineering Consultants, Inc.	Hydraulics and Hydrology
James Nettum, P.E.	PRC Engineering Consultants, Inc.	Civil-Structural and Mechanical
Razi Quraishi, R.P.G.	PRC Engineering Consultants, Inc.	Geology
John Lauth, P.E.	PRC Consoer Townsend, Inc.	Civil-Structural
Marc Ramsey	Representative of Fred Weber, Inc.	
Ken Kaiser	Representative of Fred Weber, Inc.	

Specific observations are discussed below.

b. Dam

The overall condition of the dam appeared to be fair, however, some items of concern were observed and are described below.

The top of dam is occasionally used as an access road and consequently, some minor tire rutting was observed (see Photo 2). On either side of the road, the top of dam is adequately protected from surface erosion by a good grass cover. No depressions or cracking indicative of an instability of the embankment were apparent. The variation in the elevation at both ends of the dam did not appear to be due to an instability of the embankment or foundation. No significant deviation in the horizontal alignment was apparent. There was no evidence of the dam ever being overtopped.

The upstream slope has no riprap protection. Consequently, considerable wave erosion of the slope above the apparent normal water surface level has occurred. The slope has been steepened to near vertical above the normal water surface level (see Photo 4) and in a few areas, the wave erosion has extended into the top of dam. Undercutting of the slope was also observed in several areas, which indicates future sloughing of the slope is possible. The portion of the slope above the wave erosion was protected against surface runoff erosion by an adequate cover of grass (see Photo 4). No bulges, depressions or cracks indicative of any movement of the embankment or foundation were apparent. Several medium sized trees were growing on the slope.

The downstream slope is adequately protected against surface runoff by a good grass cover and no erosional problems due to surface runoff were observed. No bulges, depressions or cracks indicative of an instability of the slope were apparent. An area of trees and standing water approximately 90 feet long and located about 135 feet to the left of the right abutment was observed at the

toe of the dam. It was undetermined whether the source of the water was due to seepage through the embankment or foundation or was due to surface runoff which has collected in the area, since the area has no means of being drained. No measurable flow of seepage was observed in the above mentioned area, on the embankment or downstream of the toe. No trees were growing on the downstream slope.

The right abutment slopes gently upward from the dam and the left abutment is at approximately the same elevation as the top of dam. No instabilities, seepage or erosion which were felt to be detrimental to the safety of the dam were observed on either abutment. However, one erosion gully was observed on the left abutment but it was felt that the gully does not affect the safety of the dam in its present condition nor will it affect the dam in the future if further erosion occurs.

Animal burrows measuring up to 4 inches in diameter were observed on the upstream slope. However, no evidence of burrowing animals was apparent on either the downstream slope or either abutment.

c. Project Geology and Soils

(1) Project Geology

The damsite is located on an unnamed tributary of the Missouri River in the Springfield Plateau section of the Ozark Plateaus Physiographic Province. The Springfield Plateau includes that part of the Ozarks which is underlain mainly by rocks of Mississippian age. Most of the Springfield Plateau are prairies, which are separated by valleys cut 200 to 300 feet below the upland surface. Most of the area of the Springfield Plateau is overlain by a mantle of chert derived by weathering of the Mississippian Limestone. Widespread distribution of dolomite and limestone bedrock with deep dissection is responsible for the development of many springs in the regional area of the damsite. A major component

of the surface discharge of water to the regional drainage is contributed by these springs.

Topography at the damsite vicinity is rolling to hilly with V-shaped valleys. Elevations of the ground surface range from 637 feet above M.S.L. approximately 2.9 miles northeast of the damsite to 515 feet above M.S.L. at the damsite. The reservoir slopes are generally from 6 degrees to 12 degrees from horizontal. The reservoir slopes are stable and the reservoir appears to be watertight. The area near the damsite is covered with loess deposits consisting of brownish gray, slightly plastic clayey silt, trace fine sand.

The regional bedrock geology beneath the loess deposits in the damsite area as shown on the Geologic Map of Missouri (1979), (see Plate 5) consist of Pennsylvanian age rocks of the Pleasanton-Marmaton-Cherokee Group and Mississippian St. Louis Formation. The predominant bedrock underlying the loess deposits in the vicinity of the damsite are the Pennsylvanian age rocks of Pleasanton-Marmaton Group (cyclic deposits of shale, limestone and sandstone). No outcropping of bedrock was seen at the damsite.

No faults have been identified in the vicinity of the damsite. The closest trace of a fault to the damsite is the St. Louis fault nearly 14 miles east of the damsite. The St. Louis fault had its last movement in Paleozoic time. Thus, the fault has no effect on the damsite.

No boring logs or construction reports were available that would indicate foundation conditions encountered during the construction. Based on the visual inspection the embankment rests on loess deposits. The approach and discharge channels of the spillway were cut into the loessial soils of the right abutment. The corrugated metal pipe located at the control section of the spillway rests on the loessial soils.

(2) Project Soils

According to Mr. Ramsey, the soil overburden in the reservoir area is of the Knox soil group with soil deposits up to 40 feet to the underlying bedrock at the damsite. The Knox soil type, as classified by the Soil Conservation Service, is a loess deposited silty clay loam.

Materials removed from the embankment on the upstream and downstream slopes approximately 1 foot below the vegetative cover ranged from a brown, clayey silt with a trace of fine sand to a brown, slightly plastic, silty clay with a trace of fine sand. Based upon the Unified Soil Classification System, the soil would probably be classified as an ML-CL. This soil type generally has the following characteristics; impervious with a coefficient of permeability less than 1.0 foot per year, medium to low shear strength, and an intermediate resistance to piping.

d. Appurtenant Structures

(1) Spillway

The spillway channels are lined with a dense cover of long grass. Numerous trees up to 6 inches in diameter are growing along the entire length (see Photo 9). The channels are stable as no erosion was seen. The control section for the spillway is the 24-inch diameter CMP under the road which extends across the dam. The pipe is silted up to within 0.7 foot at the inlet and 0.4 foot at the outlet, therefore the capacity of the pipe is considerably reduced from its original condition (see Photo 7). The wire screen and its wooden frame supports across the inlet of the spillway also appears to hinder the proper operation of the spillway.

(2) Outlet Works

No low level outlet or outlet works were provided for this dam.

e. Reservoir Area

The reservoir water surface elevation at the time of the inspection was 503.4 feet above M.S.L. The normal water surface level for the reservoir is unknown; however, due to physical evidence observed on the upstream slope and along the reservoir rim, the normal water surface level elevation was assumed to be at 505.5, which is one foot below the spillway crest. The surface area of the reservoir at the apparent normal water level is about 6.5 acres.

The rim appeared to be stable with no major erosional problems observed. The land around the reservoir slopes gently upward from the rim and is primarily used for agricultural purposes (see Photo 10). One house is built upstream of the reservoir. No evidence of excessive siltation was observed in the reservoir on the day of the inspection.

f. Downstream Channel

The downstream channel near the dam is undefined and obstructed with trees and bushes. Discharges from the spillway flow along the right abutment until they reach a 30-inch diameter CMP that leads into a concrete lined basin. The concrete lined basin collects water from several sources and directs it into a 8 feet wide by 6.25 feet high box culvert which passes under the interstate highway.

3.2 Evaluation

The severe obstruction of the spillway pipe due to the siltation is cause for alarm. The siltation severely reduces the capacity of the spillway, which could cause the dam to be overtopped during large flows thus endangering the safety of the dam.

The following conditions were also observed, which could adversely affect the dam in the near future.

1. The area of standing water at the toe of the dam could affect the structural stability of the dam, however, it was undetermined if the condition was due to seepage or if surface runoff collected in the area and was unable to drain off. If the standing water was indeed due to seepage and the rate of seepage were to increase, it is possible that the seepage could transport soil particles. This could cause piping of embankment material which could lead to an eventual failure of the embankment. No flowing seepage was observed in the area on the day of the inspection.

2. The trees and brush in the spillway channels and the wire screen and its supports across the inlet of the spillway also reduce the capacity of the spillway, but does not appear to have caused any damage to the dam at this time. However, flows of an appreciable size could easily cause overtopping of the dam, which could seriously affect the stability of the embankment.

3. The trees observed on the upstream slope pose a potential danger to the safety of the dam depending upon the extent of the root system. The roots of large trees present possible paths for piping through the embankment. The root systems can also do damage to the embankment from being uprooted by a storm.

4. The animal activity observed on the upstream slope could jeopardize the safety of the dam. The holes created by the small animals make avenues for possible piping.

5. The wave erosion on the upstream slope does not appear to affect the stability of the dam in its present condition, due to the fact that the top of dam is fairly wide and the freeboard height above the apparent normal water surface is only 2.5 feet. However, continual erosion of the slope can only be detrimental to the stability of the dam.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

There are no specific procedures which are followed for the operation of Branneky Lake Dam. The water level below the spillway crest is allowed to remain as high as possible.

4.2 Maintenance of Dam

Fred Weber, Inc. purchased a part of the dam that includes the spillway channel from Gould, Inc. of Rollings Meadows, Illinois several months ago. It appears that the dam and the spillway have been neglected and have received little or no maintenance. The spillway channels have overgrown with brush and trees. The 24-inch diameter spillway pipe has almost completely filled up with silt. The upstream dam slope has been eroded by wave action and several medium sized trees are growing on the upstream slope of the dam.

4.3 Maintenance of Operating Facilities

There are no operating facilities associated with Branneky Lake Dam.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any existing warning system in effect for the dam, such as an electrical warning system or a manual notification plan.

4.5 Evaluation

The dam appears to be neglected and the maintenance for Branneky Lake Dam seems to be inadequate at this time. The remedial measures outlined in Section 7 should be undertaken to improve the condition of the dam.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

No hydrologic and hydraulic design data are available for Branneky Lake Dam. The sizes of physical features utilized to develop the stage-outflow relation for the overtopping of the dam were prepared from field notes and sketches prepared during the field inspection. The reservoir elevation-area data were based on the U.S.G.S. St. Charles and Creve Coeur, Missouri Quadrangle topographic maps (7.5 minute series). The overtop release rates and the reservoir elevation-area data are presented in Appendix B.

The hydrologic soil group of the watershed was determined from information available in the U.S.D.A. Soil Conservation Service publication "Missouri General Soil Map and Soil Association Descriptions", 1979. The Probable Maximum Precipitation (PMP) used to determine the Probable Maximum Flood (PMF) was determined by using the U.S Weather Bureau publication "Hydrometeorological Report No. 33" (April 1956). The 100-year and the 10-year floods were derived from the 100-year rainfall and the 10-year rainfall, respectively, of St. Louis, Missouri.

b. Experience Data

It is believed that records of reservoir stage or spillway discharge are not maintained for this site. However, there was no evidence of the dam ever having been overtopped.

c. Visual Observations

Observations made of the spillway during the visual inspection are discussed in Section 3.1d and evaluated in Section 3.2.

d. Overtopping Potential

Both the Probable Maximum Flood and one-half of the Probable Maximum Flood, when routed through the reservoir, resulted in overtopping of the dam. The peak inflows of the PMF and one-half of the PMF are 1,918 cfs and 959 cfs, respectively. The peak outflow discharges for the PMF and one-half of the PMF are 1,711 and 781 cfs, respectively. Since the spillway culvert is almost completely obstructed, its capacity has a negligible affect on the flood routings. The PMF overtopped the dam by 1.71 feet and one-half of the PMF overtopped the dam by 1.22 feet. The total duration of flow over the dam is 17.1 hours during the occurrence of the PMF and 15.0 hours during one-half of the PMF. The reservoir of Branneky Lake Dam is capable of storing a flood equal to approximately 5 percent of the PMF just before overtopping the dam. The reservoir of Branneky Lake Dam will not accommodate the one-percent chance flood nor the ten-percent chance flood without overtopping the dam. The one-percent chance flood will overtop the dam by 0.53 feet with a total duration of 12.9 hours and the ten-percent chance flood will overtop the dam by 0.15 feet with a total duration of 12.4 hours.

The surface soils on the embankment range from a clayey silt to a silty clay. The top of dam does have a good grass cover; however, the dam will be overtopped by 1.22 feet during the occurrence of the one-half PMF. The high velocity of flow across the top of the dam and on its downstream slope can cause severe erosion to the embankment and could lead to an eventual failure of the dam. The 46-foot wide crest of the dam, which has a good grass cover, may withstand some overtopping for a short period; however, due to the long duration of overflow during the one-half PMF, the safety of the dam is definitely threatened.

The failure of the dam could cause extensive damage to the property downstream of the dam and possible loss of life. The estimated damage zone extends approximately one mile downstream of the dam and includes four dwellings, one building, and an interstate highway.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no major signs of settlement or distress observed on the embankment or foundation during the visual inspection. The source of standing water observed at the toe of the dam is unknown; however, if it is due to seepage, the condition could be detrimental to the stability of the dam. At the present time, the possible seepage does not appear to be serious enough to constitute an unsafe condition. The wave erosion on the upstream slope does not appear to endanger the structural integrity of the dam; however, continual erosion can only be detrimental to the stability of the embankment. In the absence of seepage and stability analyses, no quantitative evaluation of the structural stability can be made.

The structural stability of the spillway is good, however, it is so clogged with silt, heavy grass, and trees that it is severely hampered in carrying out its intended purpose.

b. Design and Construction Data

No design computations pertaining to the embankment were uncovered during the report preparation phase. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available. No embankment or foundation soil parameters were available for carrying out a conventional stability analysis on the embankment. No construction data or specifications relating to the degree of embankment compaction were available for use in a stability analysis.

c. Operating Records

No operating records are available relating to the stability of the dam or its appurtenant structures. No regulated outlet works were provided for the dam. The water level on the day of the visual inspection was 4.6 feet below the minimum top of dam.

d. Post Construction Changes

No post construction changes are known to exist which will affect the structural stability of the dam.

e. Seismic Stability

The dam is located in Seismic Zone 2, as defined in the "Recommended Guidelines for Safety Inspection of Dams" as prepared by the Corps of Engineers (see Plate 8). Seismic Zone 2 is characterized by a moderate earthquake hazard. An earthquake of the magnitude that would be expected in Seismic Zone 2 should not cause significant distress to a well designed and constructed earth dam. Available literature indicates that no active faults exist near the vicinity of the damsite. The maximum recorded historic magnitude earthquake in the immediate vicinity of the damsite was the January 24, 1902 event of magnitude 5 located at a distance of 12 miles southeast of the damsite. This event cannot be correlated with known tectonic structure and is considered to probably be related to the release of accumulated residual strain along a buried pre-Quaternary fault. The attenuation of this event to the damsite would produce a peak ground acceleration of less than 0.05g which would not produce a significant seismic impact on the dam.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and the visual inspection. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation, however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based upon observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to realize that the condition of a dam depends upon numerous and constantly changing internal and external factors, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be assurance that an unsafe condition could be detected.

a. Safety

The spillway capacity of Branneky Lake Dam is found to be unusually small and seriously inadequate. The reservoir will store about 5 percent of the PMF without overtopping the dam. If the dam is overtopped, the safety of the embankment will be in jeopardy. Due to the susceptibility of the material used for the embankment to erosion, high velocity flow on the downstream slope could cause excessive erosion and eventually lead to the failure of the dam.

The overall condition of the dam appears to be fair; however, the severe capacity reduction of the spillway due to the siltation in the corrugated metal pipe jeopardizes the safety of the dam. No quantitative evaluation of the structural safety of the embankment can be made in view of the absence of seepage and stability analyses. The present embankment, however, has performed satisfactorily since its construction without failure or evidence of instability. No evidence was observed to indicate that the dam has ever been overtopped. The safety of the dam can be improved if the deficiencies described in Sections 3.2 and 6.1a are properly corrected as described in Section 7.2b.

b. Adequacy of Information

The conclusions presented in this report are based upon field measurements, past performance and the present condition of the dam. Information on the design hydrology, hydraulic design, operation, and maintenance of the dam was not available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Urgency

The remedial measures recommended in Paragraph 7.2b should be accomplished within a reasonable period of time. The items recommended in paragraph 7.2a should be pursued on a high priority basis.

d. Necessity for Phase II [illegible]tion

Based upon results of the Phase I inspection, assuming the remedial measures recommended in Paragraph 7.2 are undertaken, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternatives

There are several general options that may be considered to reduce the possibility of dam failure or to diminish the harmful aspects of such a failure. Some of these options are:

1. Increase the spillway capacity to pass one-half of the PMF without overtopping the dam. The spillway should also be protected to prevent excessive erosion during the occurrence of one-half of the PMF.

2. Increase the height of the dam enough to pass one-half of the PMF without overtopping the dam; an investigation should be done which also includes studying the effects that increasing the height of the dam would have on the structural stability of the existing embankment. The overtopping depth during the occurrence of one-half of the PMF, stated in Section 5.1d, is not the required or recommended increase in the height of the dam.

3. A combination of 1 and 2 above.

b. O & M Procedures

1. The spillway pipe should be cleared of sediment. The invert of the approach and discharge channels should be graded to reduce siltation in the pipe.

2. The area of standing water at the toe of the dam should be further investigated to determine if the condition is due to seepage or surface runoff. If the condition is indeed due to seepage, the area should be monitored to detect any changes in location, turbidity, and quantity of water. Any changes should be investigated further and repairs made as necessary.

3. The welded wire screen should be either enlarged and the vertical supports kept out of the channel bottom and side slope area or removed altogether.

4. All of the trees on the upstream slope and in the spillway channels should be removed and regrowth prevented. Removal of the trees should be under the guidance of an engineer experienced in the design and construction of earth dams.

5. All burrowing animals should be eliminated from the embankment and their burrows properly backfilled and compacted.

6. The erosion due to wave action on the upstream slope should be properly repaired and the slope adequately protected from further damage.

7. *The vegetation on the embankment*, especially the vegetation on the downstream slope, should be properly maintained and an adequate vegetative cover retained on the embankment to protect it from surface erosion and to prevent excessive erosion in the event the dam is overtopped. Large vegetation, such as bushes and trees, should be prevented from growing on the embankment.

8. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of earth dams.

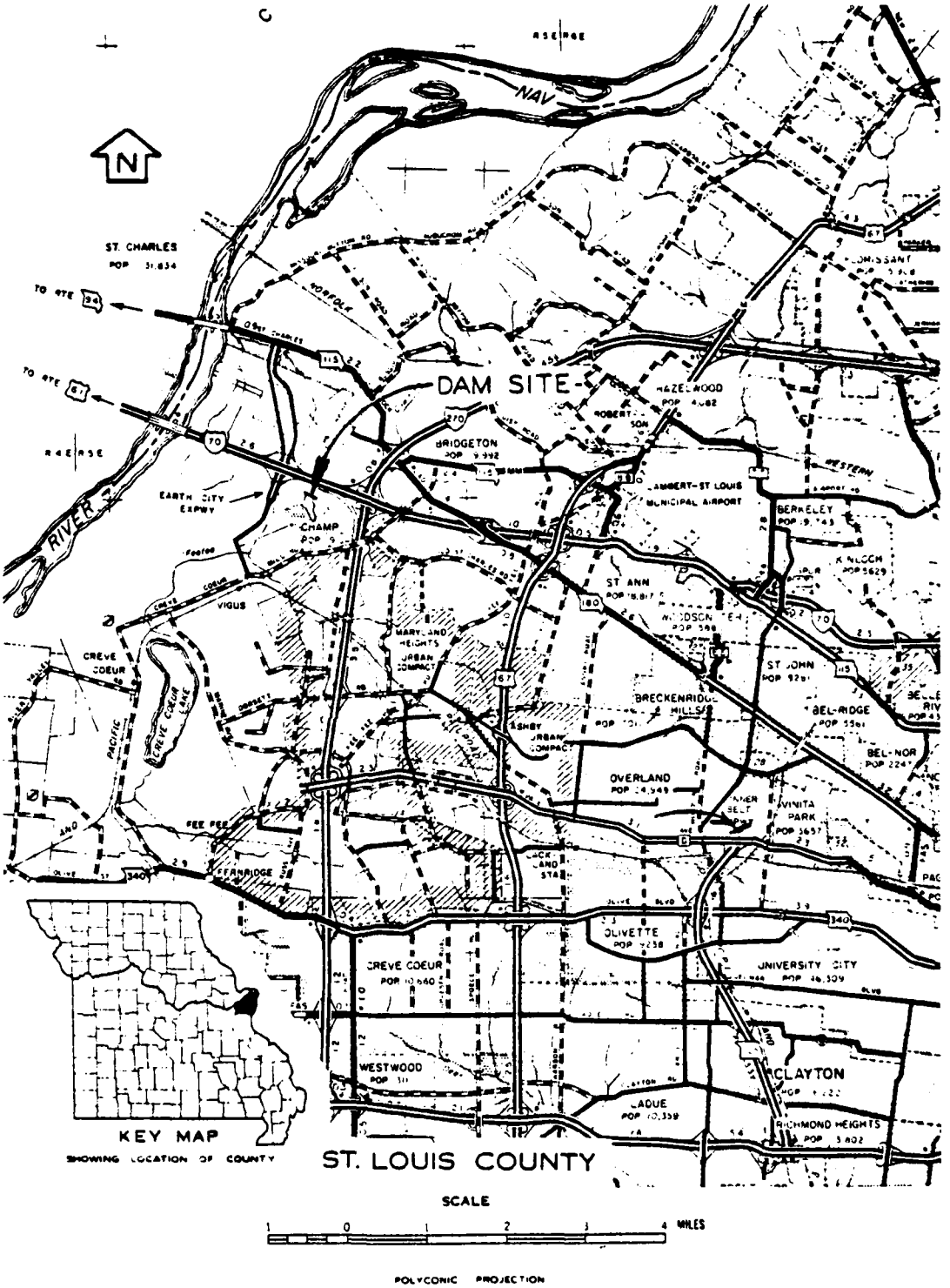
9. The owner should initiate the following programs:

   (a) Periodic inspection of the dam by a professional engineer experienced in the design and construction of earth dams.

(b) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

PLATES

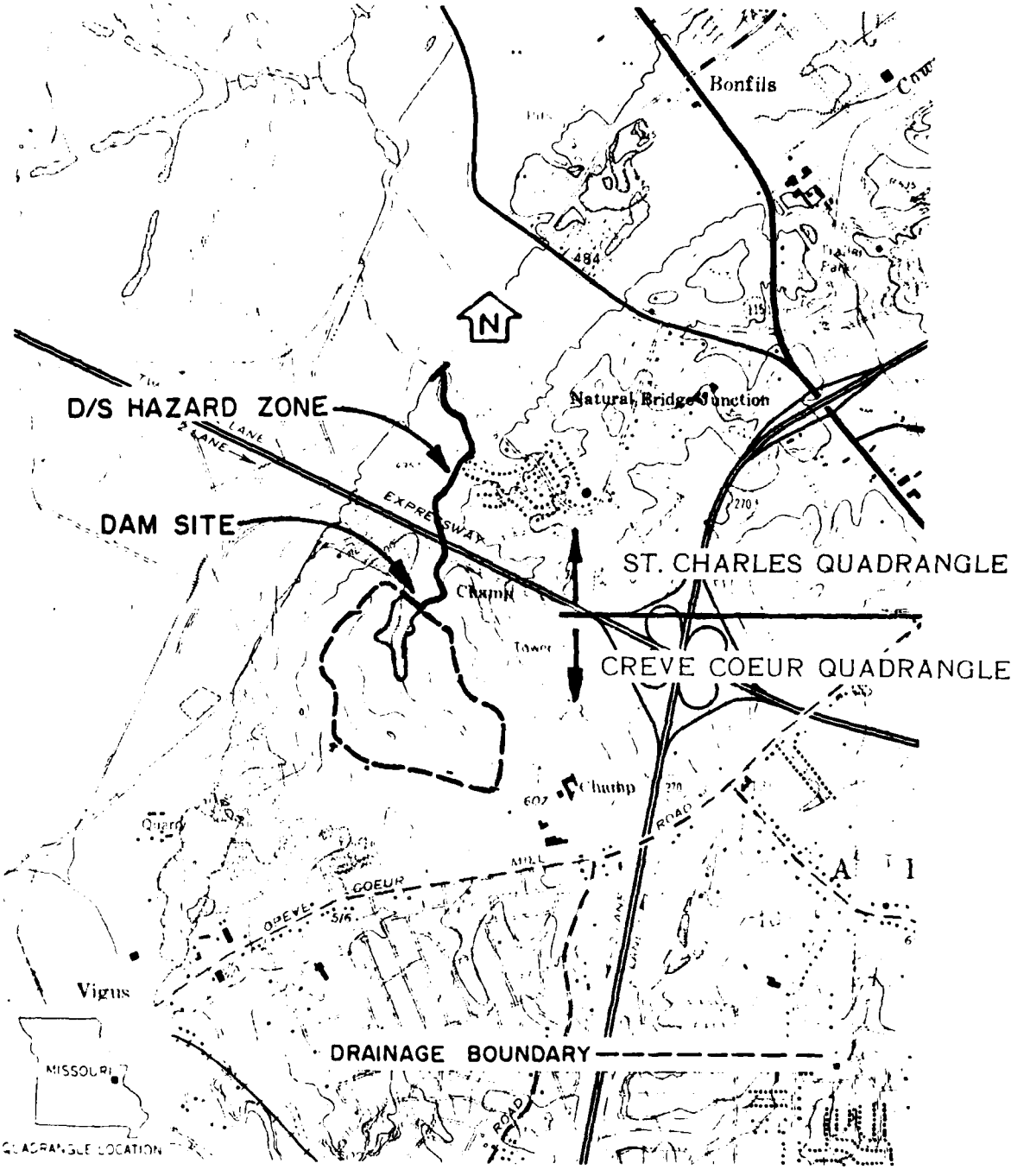
PLATE 1



LOCATION MAP – BRANNEKY LAKE DAM

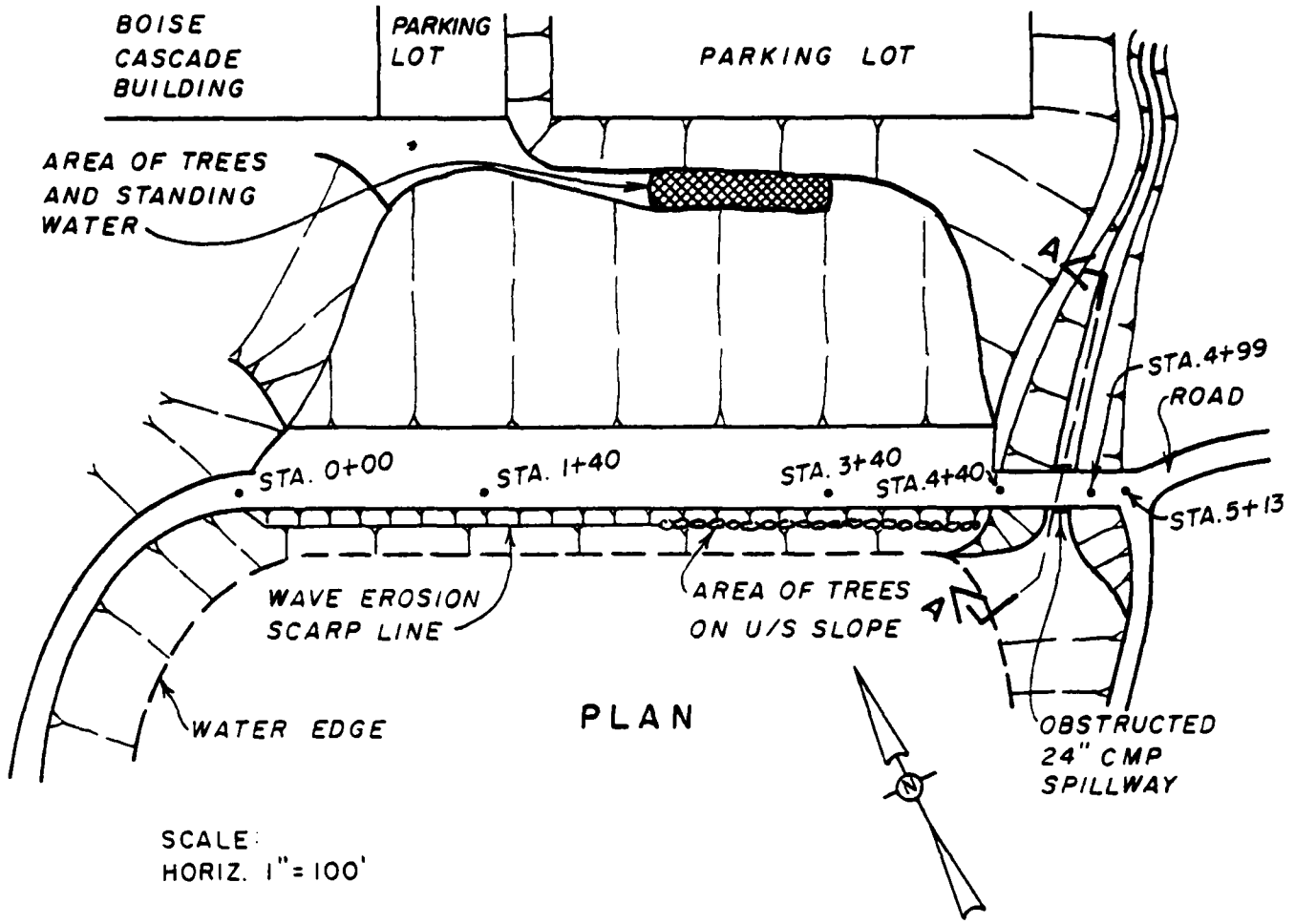
MO.-31393

PLATE 2



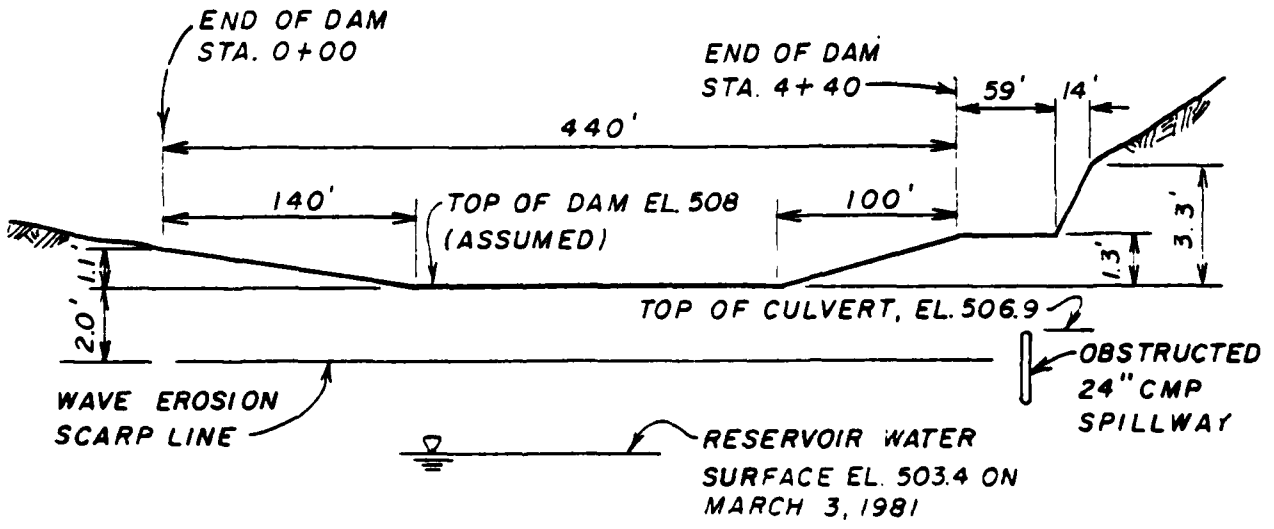
BRANNEKY LAKE DAM (MO.-31393)

DRAINAGE BASIN AND
DOWNSTREAM HAZARD ZONE



PLAN

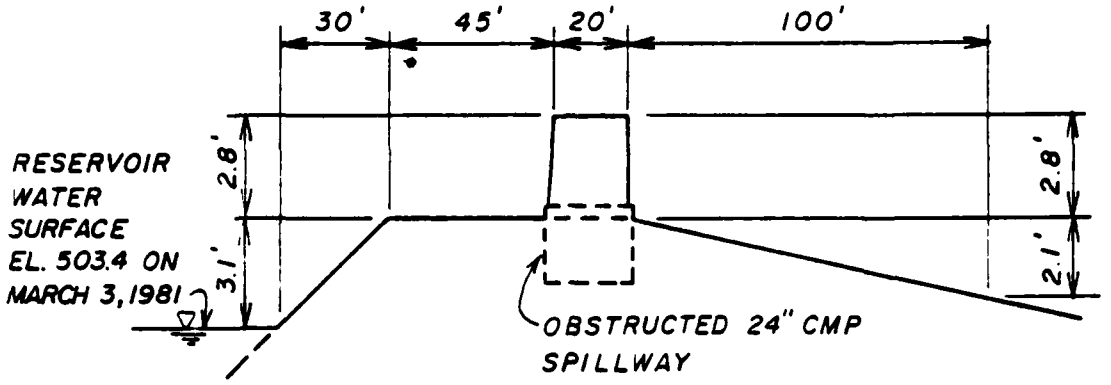
SCALE:
HORIZ. 1" = 100'



SCALE:
HORIZ. 1" = 100'
VERT 1" = 5'

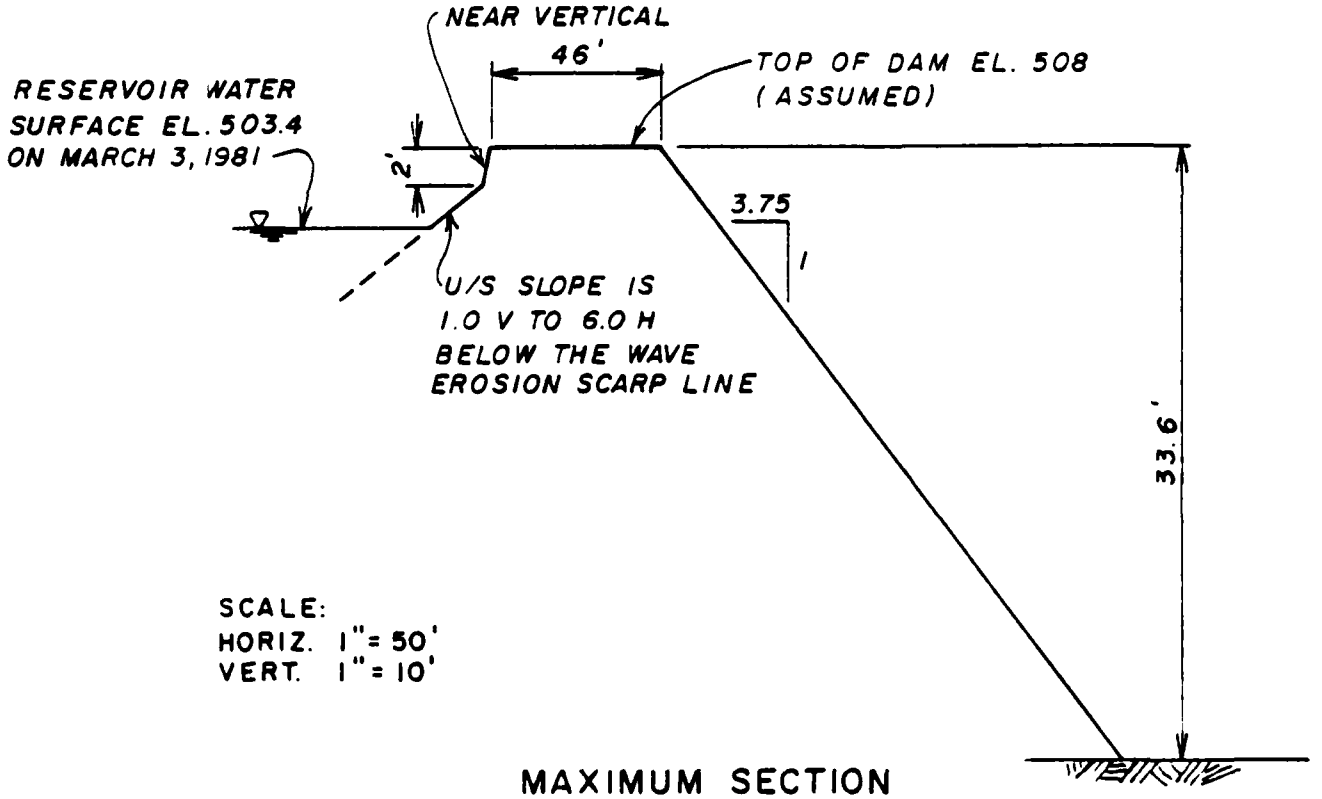
ELEVATION

BRANNEKY LAKE DAM (MO. 31393)
PLAN AND ELEVATION
(SHEET 1 OF 2)



SCALE:
HORIZ. 1" = 50'
VERT. 1" = 5'

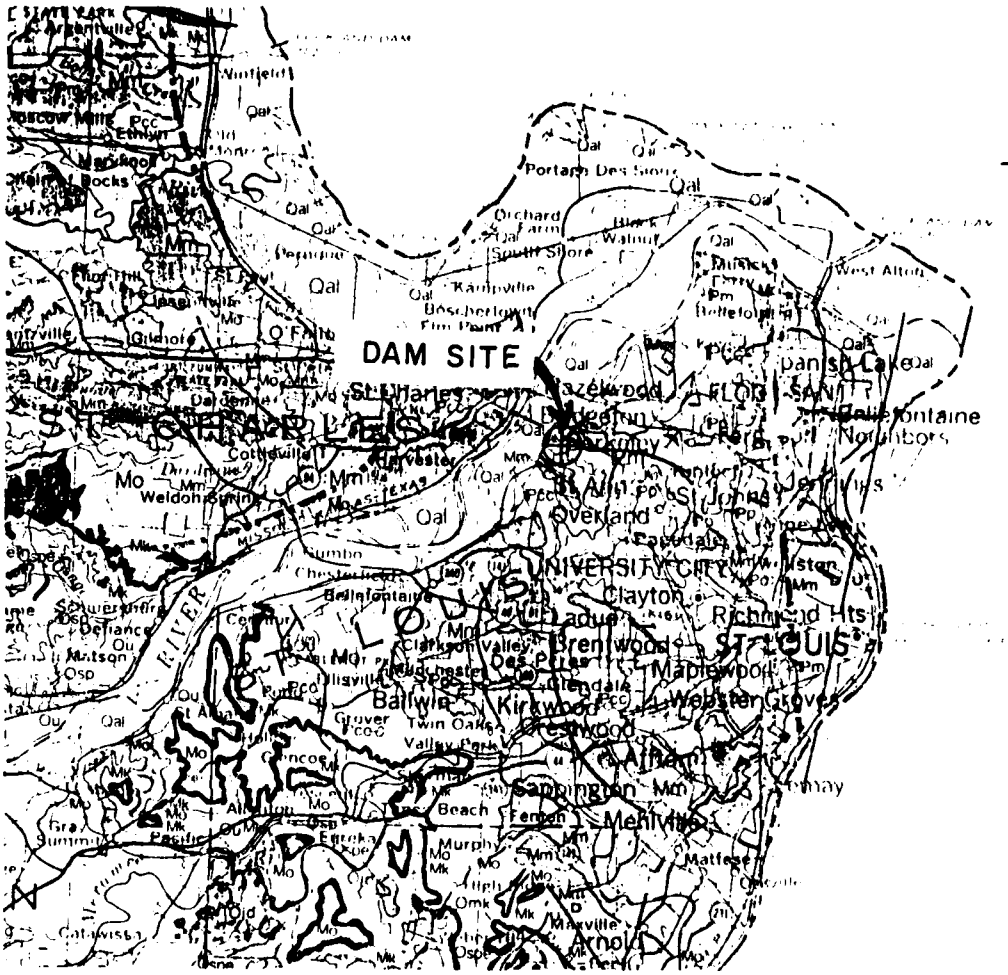
SECTION A-A
(SPILLWAY PROFILE)



SCALE:
HORIZ. 1" = 50'
VERT. 1" = 10'

MAXIMUM SECTION
(STATION 1+40)

BRANNEKY LAKE DAM (MO. 31393)
SPILLWAY PROFILE AND MAXIMUM SECTION
(SHEET 2 OF 2)



SCALE

10 0 10 20 30 40 Miles

⊕ LOCATION OF DAM

NOTE: LEGEND FOR THIS MAP IS ON PLATES 6 AND 7.

REFERENCE:

GEOLOGIC MAP OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
MISSOURI GEOLOGICAL SURVEY
KENNETH H. ANDERSON, 1979

REGIONAL GEOLOGICAL MAP OF BRANNEKY LAKE DAM

LEGEND

PERIOD	SYMBOL	DESCRIPTION
QUATERNARY	Qal	ALLUVIUM: SAND, SILT, GRAVEL
PENNSYLVANIAN	Pp	PLEASANTON GROUP: CYCLIC DEPOSITS OF SANDSTONE, SHALE AND LIMESTONE
	Pm	MARMATON GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
	Pcc	CHEROKEE GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
MISSISSIPPIAN	Mm	ST. LOUIS FORMATION: LIMESTONE INTERBEDDED WITH SHALE
	Mm	SALEM FORMATION: LIMESTONE INTERBEDDED WITH SHALE
	Mm	WARSAW FORMATION: ARGILLACEOUS LIMESTONE AND CALCAREOUS SHALE
	Mo	KEOKUK– BURLINGTON FORMATION: CHERTY GRAYISH BROWN SANDY LIMESTONE
	Mk	UNDIFFERENTIATED CHOUTEAU GROUP: LIMESTONE
	Mk	HANNIBAL FORMATION: SHALE AND SILTSTONE

LEGEND

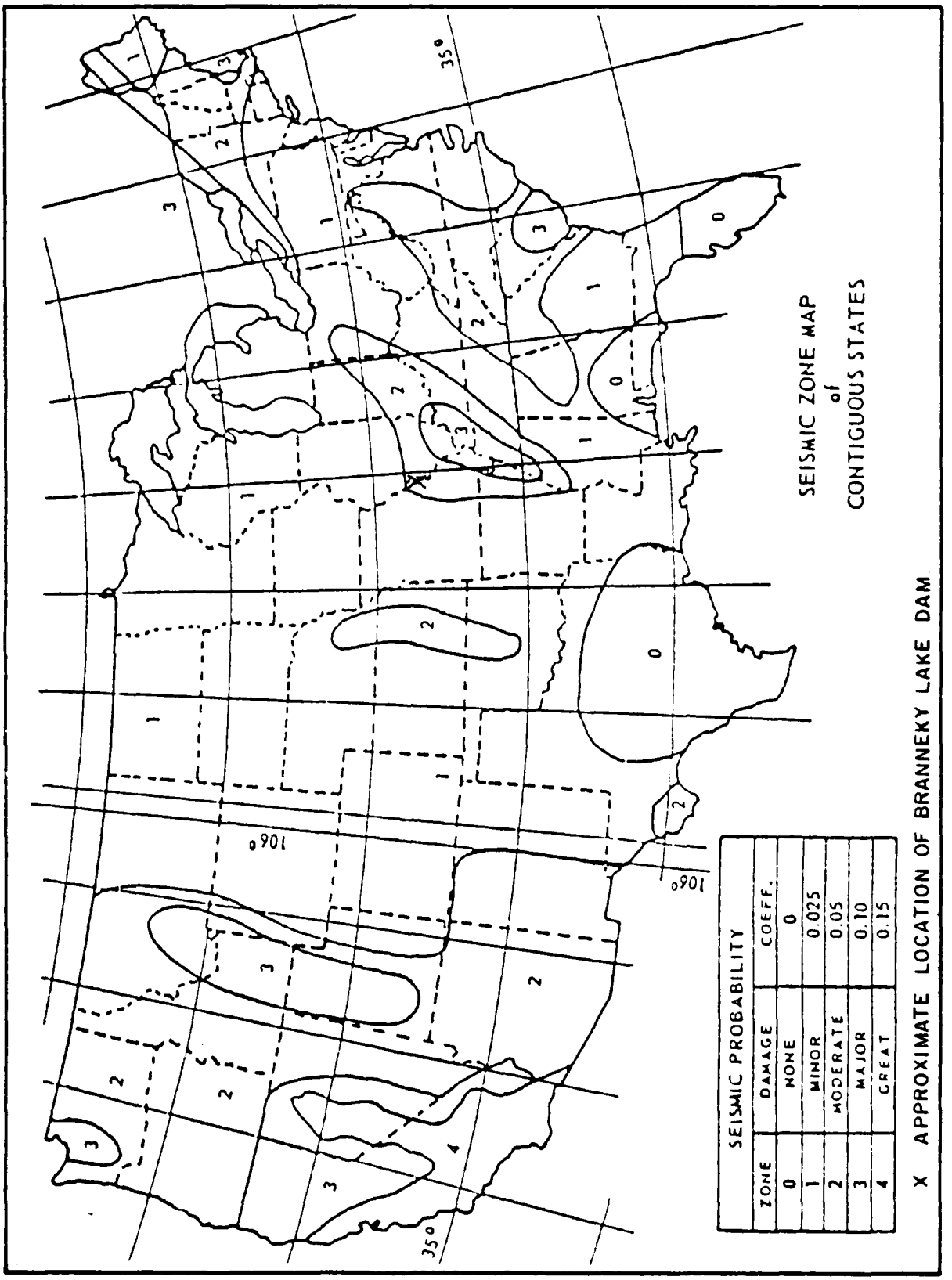
PERIOD	SYMBOL	DESCRIPTION
ORDOVICIAN	Ou	NOIX LIMESTONE
	Omk	MAQUOKETA SHALE, KIMMSWICK LIMESTONE
	Odp	DECORAH FORMATION: GREEN TO GRAY CALCAREOUS SHALE WITH THIN FOSSILIFEROUS LIMESTONE
	Osp	ST. PETER SANDSTONE
	Ospe	ST. PETER SANDSTONE, EVERTON FORMATION
	Ojd	JOACHIM DOLOMITE
	Ojc	JEFFERSON CITY DOLOMITE

U / D — NORMAL FAULT

U / D — INFERRED FAULT

U = UPTHROWN SIDE
D = DOWNTHROWN SIDE

PLATE 8



SEISMIC PROBABILITY		
ZONE	DAMAGE	COEFF.
0	NONE	0
1	MINOR	0.025
2	MODERATE	0.05
3	MAJOR	0.10
4	GREAT	0.15

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

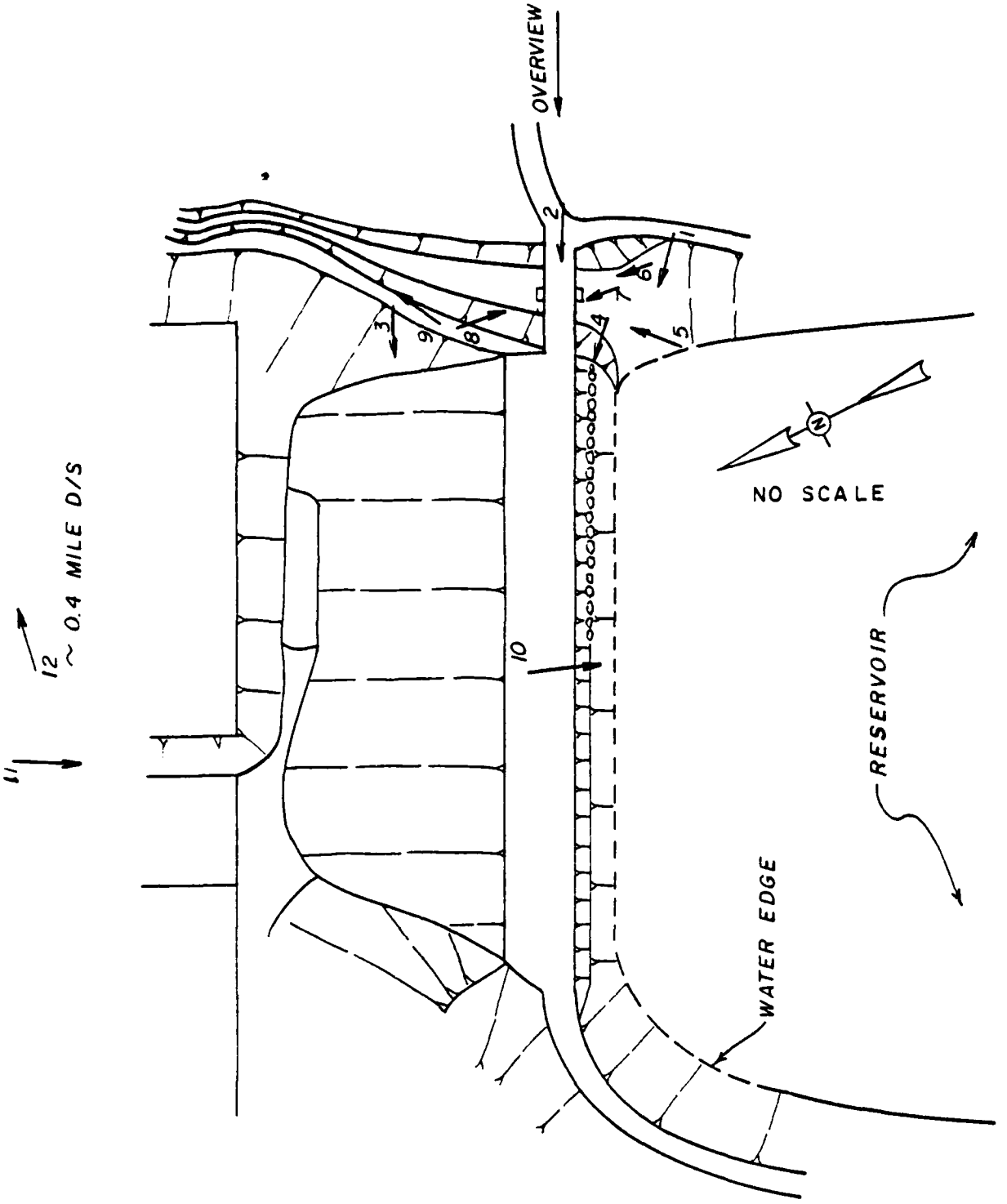


PHOTO INDEX
FOR
BRANNEKY LAKE DAM

Photo 1 - View of the upstream slope from the right abutment.

Photo 2 - View of the top of dam from the right abutment with the spillway in the foreground.

Photo 3 - View of the downstream slope from the right abutment. The area of standing water and trees at the toe of the dam is shown in the right-hand side of the Photo.

Photo 4 - Close-up view of the upstream showing the near vertical slope due to wave action. Note the evidence of the normal water surface level at the left-hand side of Photo.

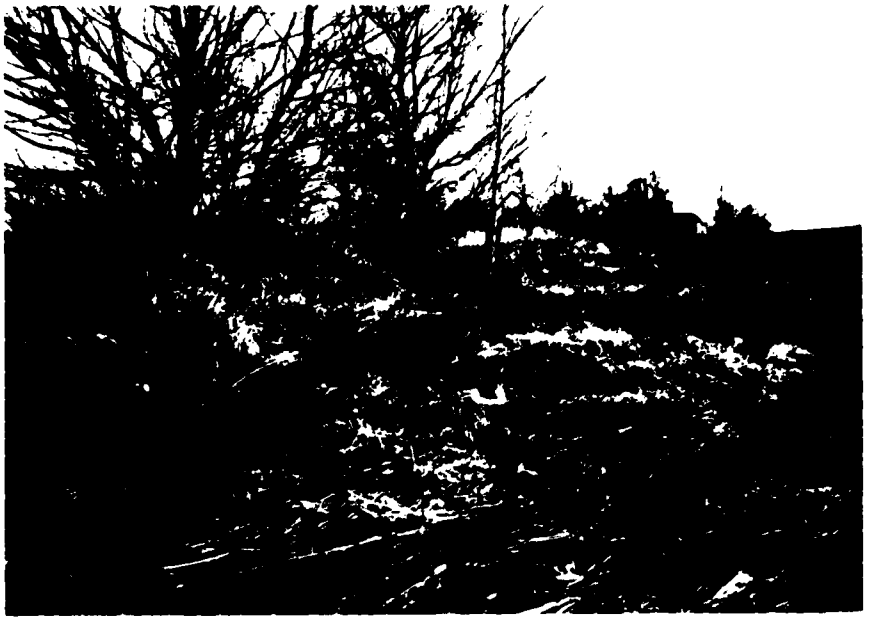


Photo 5 - View of the entrance to the approach channel of the spillway from the reservoir.

Photo 6 - View of the approach channel of the spillway. Note the partially plugged C.M.P. in the center of the Photo.

Photo 7 - Close-up view of the partially plugged 24-inch-diameter C.M.P. of the spillway.

Photo 8 - View of the discharge channel of the spillway looking towards the reservoir.

Photo 9 - View of the discharge channel of the spillway looking downstream.

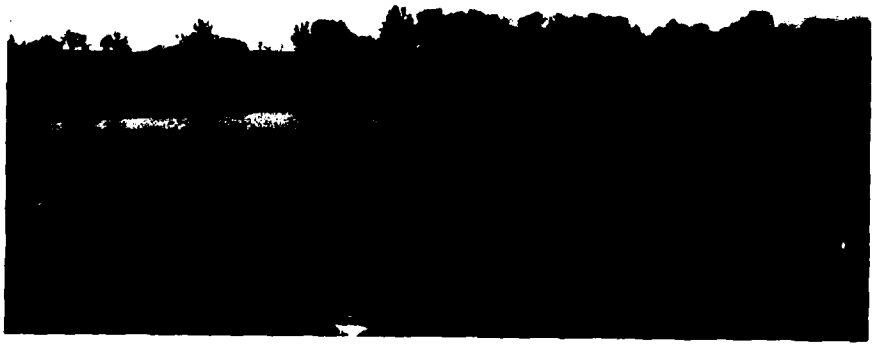


Photo 10 - View of the reservoir and rim.

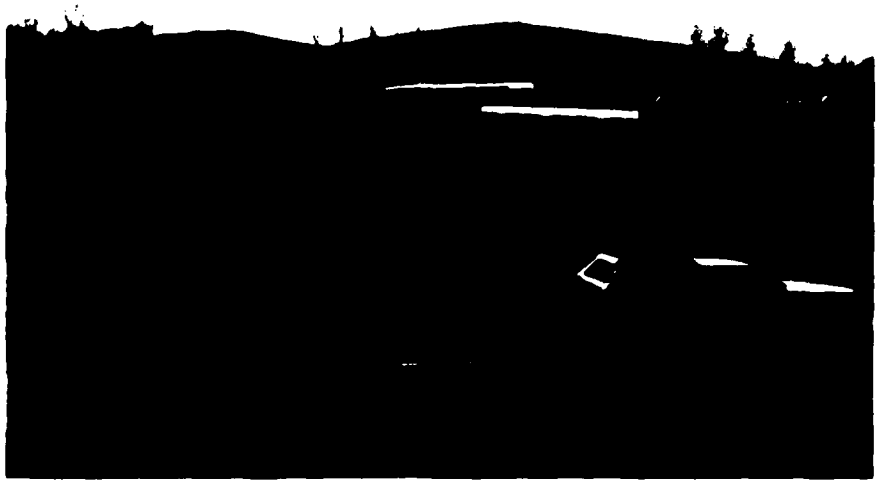


Photo 11 - View of an Interstate highway (I-70) and the Boise Cascade Building just downstream of the dam. Note the embankment in the background.

Photo 12 - View of two dwellings downstream of the dam, which appear to be in the downstream hazard zone. Note downstream channel in the foreground.

APPENDIX B

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

BRANNEKY LAKE DAM

HYDROLOGIC AND HYDRAULIC DATA, ASSUMPTIONS AND METHODOLOGY

1. SCS Unit Hydrograph procedures and the HEC-1DB computer program are used to develop the inflow hydrographs. The hydrologic inputs are as follows:

   (a) Twenty-four hours probable maximum precipitation from Hydrometeorological Report No. 33, 24-hour 100-year rainfall and 24-hour 10-year rainfall of St. Louis, Missouri.

   (b) Drainage area = 0.14 square miles.

   (c) Lag time = 0.10 hours.

   (d) Hydrologic Soil Group:
   Soil Group "C".

   (e) Runoff curve number:
   CN = 78 for AMC II and CN = 90 for AMC III.

2. Flow rates over the dam are based on HEC-2 generated profiles assuming critical depth at the downstream edge of the top of the dam and Manning's n = 0.03. Flow over the spillway section are determined by assuming critical flow.

3. Floods are routed through Branneky Lake to determine the ability of the reservoir to store the inflow flood volume and the severity of overtopping of the dam.

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. ___ OF ___

DAM NAME: Bonneky Lake Dam (MO 31393) — JOB NO. 1283

UNIT HYDROGRAPH PARAMETERS — BY JFK DATE 3/12/81

1) DRAINAGE AREA, $A = 0.14$ sq. mi. = (89.5 acres)

2) LENGTH OF STREAM, $L = (1.1'' \times 2000' = 2{,}200') = 0.42$ mi.

3) ELEVATION AT DRAINAGE DIVIDE ALONG THE LONGEST STREAM,

$H_1 = 611$

4) ELEVATION OF RESERVOIR AT SPILLWAY CREST, $H_2 = 506.5$

5) ELEVATION OF CHANNEL BED AT $0.85L$, $E_{85} = 600$

6) ELEVATION OF CHANNEL BED AT $0.10L$, $E_{10} = 510$

7) AVERAGE SLOPE OF THE CHANNEL, $S_{AVG} = (E_{85} - E_{10})/0.75L = 90/1650 = 5.5\%$

8) TIME OF CONCENTRATION:

A) BY KIRPICH'S EQUATION,

$$t_c = [(11.9 \times L^3)/(H_1 - H_2)]^{0.385} = [11.9 \times (0.42)^3/(611 - 506.5)]^{0.385} = 0.16 \text{ hrs.}$$

B) BY VELOCITY ESTIMATE,

SLOPE = 5.5% $\Rightarrow$ AVG. VELOCITY = 4 fps

$$t_c = L/V = 2{,}200'/4.0 \text{ fps} \times 3600 \frac{s}{hr} = 0.15 \text{ hrs}$$

USE $t_c = 0.16$ hrs

9) LAG TIME, $t_l = 0.6\, t_c = 0.10$ hrs

10) UNIT DURATION, $D \leq t_l/3 = 0.032$ hrs < 0.083 hr.

USE $D = 0.083$

11) TIME TO PEAK, $T_p = D/2 + t_l = 0.083/2 + 0.10 = 0.14$ hrs

12) PEAK DISCHARGE,

$$q_p = (484 \times A)/T_p = (484 \times 0.14 \text{ mi}^2)/0.14 \text{ hrs} = 484 \text{ cfs}$$

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

Dam Safety Inspection — SHEET NO. ____ OF ____
Branneky Lake Dam (MO. 31393) — JOB NO. 1283
Reservoir Elevation - Area Data — BY JFK DATE 3/12/8

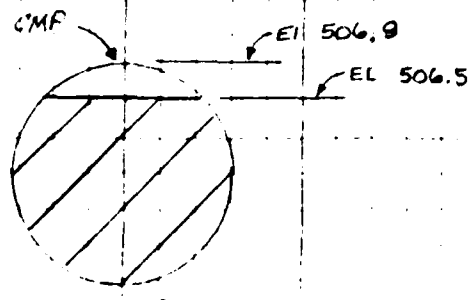
Elevation (MSL) (ft.)	Reservoir Surface Area (acres)	Remarks
490	0	Estimated streambed U/S at dam
500	2.0	Measured on U.S.G.S. 7.5' Quad
505	5.5	Measured on U.S.G.S. 7.5' Quad. (estimated elev. of water surface shown)
506.5	7.0	Invert of unobstructed portion of spillway - Interpolated
508	8.5	Top of Dam (assummed) - Interpolated
510	11.0	Measured on U.S.G.S. 7.5' Quad
520	18.5	Measured on U.S.G.S. 7.5' Quad

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

Dam Safety Inspection — SHEET NO. ____ OF ____

Brauneky Lake Dam (MO. 31393) — JOB NO. 1283

Discharge Through Partially Obstructed Culvert — BY VFK DATE 3/17/81



Slope = 0.1'/20' = 0.005

Area of Opening = $R^2 \cos^{-1}\left(\frac{R-h}{R}\right) - (R-h)\sqrt{2Rh-h^2}$, where R = radius of circ.
h = rise of segment

$= 1^2 \cos^{-1}\left(\frac{1-.4}{1}\right) - (1-.4)\sqrt{2(.4)-.4^2}$

$= 0.45\ ft^2$

Area of 24" CMP = $\pi r^2 = \pi (1')^2 = 3.14\ ft^2$

Wetted Perimeter = S + ℓ , where S = length of arc
ℓ = length of span

$S = D \cos^{-1}\frac{d}{R}$, where D = diameter of pipe
d = D − h

$\ell = 2d \tan\frac{S}{2R}$

$S = 2 \cos^{-1} 0.6 = 1.85'$

$\ell = 2(.4) \tan\frac{1.85}{2} = 1.59'$

$S + \ell = 1.85' + 1.59' = 3.45'$

Full Flow Conditions:

$K_{entrance} = 0.5$

$K_{exit} = 1.0$

$K_{friction} = 29.16 n^2 \frac{L}{R_h^{4/3}} = \frac{29.16(.03)^2(20)}{(1/3)^{4/3}} = 7.9$

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

Dam Safety Inspection — SHEET NO ____ OF ____
Brannetty Lake Dam (NJ0.31393) — JOB NO 1283
Discharge Through Partially Obstructed Culvert — BY JFK DATE 3/17/81

$H = \Sigma K \, V^2/2g$, H: W.S.El. - 506.5

$V = \sqrt{\frac{2g}{\Sigma K} H}$

$Q = VA$

$Q = \sqrt{\frac{2g}{0.4} 1.5} \; (0.45)$

$Q = 1.5$ cfs

Storage at Top of Dam = 46 ac-ft
Storage at Spillway Invert = 34 ac-ft
12 ac-ft storage

$$12 \text{ ac-ft} \times \frac{43560 \text{ ft}^2}{\text{ac}} \times \frac{s}{1.5 \text{ ft}^3} \times \frac{\text{hr}}{3600 s} \times \frac{\text{dy}}{24 \text{ hr}} = 4 \text{ days}$$

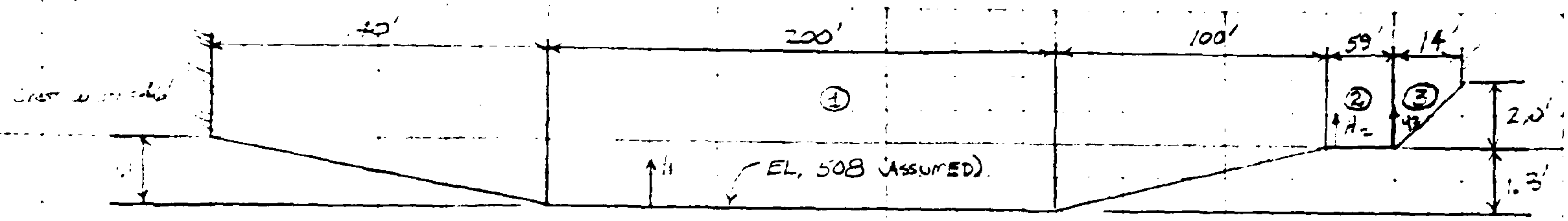
Conclusion: The unobstructed portion of the culvert is sufficient to allow the water stored in the reservoir between the top of the dam and the culvert invert to drain within a four-day period (approximately). Therefore, all routings can be started at elevation 506.5, but the discharge through the culvert can be neglected for the flood routings.

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

Dam Safety Inspection [illegible] — SHEET NO. ____ OF ____

[illegible] Lake Dam (No. 31393) — JOB NO. [illegible]-201

Overtopping [illegible] — BY JFK — DATE 2/13/91



Section 1: for $0 \le y_1 < 1.1$ — $T = 200 + y_1(2 \cdot 3 + 2)$ [illegible]; $A = y_1(200 - [illegible] y_1)$

for $1.1 \le y_1 < 1.3$ — $T = 340 + 76.9 y_1$; $A = y_1(340 + 76.9 y_1/2) - 127.3$

for $y_1 \ge 1.3$ — $T = 440$; $A = 440 y_1 - 142$

NOTE: assume critical depth at D/S edge of crest, use HEC-2 to determine y_1 at U/S edge crest

Section 2: $Q = (59) H_2^{3/2}$ — H_2 = W.S. EL − 509.3

Section 3: for $y_3 < 2.0$ — $y_3 = 4/5 H$, H = W.S. EL − 509.3; $T = 7 y_3$; $A = 3.5 y_3^2$

for $y \ge 2.0$ — $y = 2/3(H + 0.5)$; $T = 14$; $A = 14(y - 1)$

where $V = \sqrt{Ag/T}$; $Q = VA$

Refer to HEC-2 Printout (Section #1 through W.S. EL.)

Section #1 y_c	T_c	A_c	V_c	Q_c	Section #2 y_1	T_1	A_1	h_v	W.S. EL.	H_2	C	Q_2	y_3	T_3	A_3	V_3	Q_3	Q_{TOTAL}
0	0	0	0	0	0	0	0	0	508.0									0
.03	215.3	16.1	[illegible]	25	.22	246.3	50.6	.00	508.2									25
.[illegible]	224.9	29.9	[illegible]	50	.31	260.0	72.7	.01	508.3									50
.[illegible]	233.[illegible]	41.9	2.4	100	.43	238.6	106.0	.01	508.4									100
.30	260.0	68.4	2.9	200	.60	322.5	156.3	.03	508.6									200
.38	278.2	91.6	3.3	300	.72	347.7	199.1	.04	508.8									300
.40	293.4	112.9	3.5	400	.82	360.6	236.5	.04	508.9									400
.52	307.1	133.0	3.8	500	.92	397.6	270.0	.05	509.0									500
.67	336.8	179.9	4.2	750	1.11	425.1	346.3	.07	509.2	0	0	0	0	0	0	0	0	750
.79	362.0	223.0	4.5	1000	1.26	436.1	407.9	.09	509.4	0.1	2.92	5.5	.08	.56	.02	1.1	.1	1006
1.00	405.1	304.0	4.9	1500	1.50	440.0	516.4	.13	509.6	0.2	2.97	15.7	.16	1.12	.09	1.6	.1	1516
1.18	430.0	376.7	5.3	2000	1.70	440.0	604.0	.17	509.9	0.3	2.99	23.0	.24	1.68	.20	2.0	.4	2029
1.32	440.0	437.8	5.7	2500	1.87	440.0	682.3	.21	510.1	0.8	3.03	127.9	.64	4.48	1.43	3.2	4.6	2633
1.45	440.0	496.9	6.0	3000	2.03	440.0	753.0	.25	510.3	1.0	3.03	178.8	.80	5.60	2.24	3.6	8.1	3187
1.63	440.0	[illegible]	6.7	4000	2.32	440.0	379.2	.32	510.6	1.3	3.04	265.9	1.04	7.28	3.79	4.1	5.5	4281

HEC-2 INPUT AND SUMMARY TABLE

```
**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED APRI 1990
  ERROR CORR -  01,02,03,04
  MODIFICATION -  50,51,52,53,54
**************************************************

T1        MISSOURI DAM SAFETY
T2        OVERTOP RATING CURVE
T3         CHANNERY LAKE DAM

J1  ICHECK     INQ      NINV     IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
      -1.       2.       0.       0.  -1.000000      0.00      0.0       0.   509.000     0.000
J2  NPROF      IPLOT    PRFVS    XSECV     XSECH     FN        ALLOC     IBW       CHNIM     ITRACE
     1.000     0.000   -1.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
J3  VARIABLE CODES FOR SUMMARY PRINTOUT
    30.000     0.000    25.000     4.000    26.000    10.000    43.000     5.000     5.000    17.000
J5  LPRNT    NUMSEC                    ********REQUESTED SECTION NUMBERS********
    -10.000  -10.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
NC      .050      .030      .030     0.000     0.000     0.000     0.000     0.000     0.000     0.000
NT    14.000    25.000    50.000   100.000   200.000   300.000   400.000   500.000   750.000  1000.000
QT  1500.000  2000.000  2500.000  3000.000  4000.000     0.000     0.000     0.000     0.000     0.000

X1     1.000     6.000     0.000   440.000     0.000     0.000     0.000     0.000     0.000     0.000
GR   511.000     0.000   509.100     0.000   508.000   140.000   508.000   340.000   509.300   440.000
GR   511.000   440.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000

X1     2.000     0.300     0.000     0.000    46.000    46.000    46.000     0.000     0.000     0.000
X3     0.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
```

B-8

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**********************************************
  HEC2 RELEASE DATED NOV 76 UPDATED APRI 1980
  ERPON CORR - 01,02,03,04
  MODIFICATION - 50,51,52,53,54
**********************************************
```

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

BRANNERY LAKE DAM

SUMMARY PRINTOUT

	SECNO	DEPTH	AREA	TOPWID	VCH	HV	Q	EG	1DK*S	K*XNCH
*	1.000	.18	16.06	215.77	1.56	.04	25.00	508.11	315.71	30.00
*	1.000	.12	25.90	224.90	1.93	.06	50.00	508.18	271.05	30.00
*	1.000	.19	41.86	238.95	2.39	.09	100.00	508.28	237.29	30.00
*	1.000	.30	68.41	260.65	2.92	.13	200.00	508.43	207.36	30.00
*	1.000	.38	91.58	278.21	3.28	.17	300.00	508.55	192.43	30.00
*	1.000	.46	112.92	293.45	3.54	.19	400.00	508.65	182.76	30.00
*	1.000	.52	135.02	307.13	3.76	.22	500.00	508.74	175.72	30.00
*	1.000	.67	179.89	336.85	4.17	.27	750.00	508.94	163.52	30.00
*	1.000	.79	223.00	362.04	4.48	.31	1000.00	509.11	156.40	30.00
*	1.000	1.00	303.96	405.14	4.93	.38	1500.00	509.38	145.57	30.00
*	1.000	1.18	376.72	430.58	5.31	.44	2000.00	509.62	137.32	30.00
*	1.000	1.32	437.80	440.00	5.71	.51	2500.00	509.82	133.90	30.00
*	1.000	1.45	496.89	440.00	6.04	.57	3000.00	510.02	126.53	30.00
*	1.000	1.69	599.47	440.00	6.67	.69	4000.00	510.38	120.50	30.00
	2.000	.22	50.55	246.26	.49	.00	25.00	508.23	8.23	30.00
	2.000	.31	72.71	264.00	.69	.01	50.00	508.32	10.76	30.00
	2.000	.43	105.99	288.59	.94	.01	100.00	508.44	13.80	30.00
	2.000	.60	156.79	322.54	1.28	.03	200.00	508.62	17.35	30.00
	2.000	.72	198.11	347.71	1.51	.04	300.00	508.76	19.79	30.00
	2.000	.82	236.47	369.56	1.69	.04	400.00	508.87	21.15	30.00
	2.000	.92	269.99	387.64	1.85	.05	500.00	508.97	22.64	30.00
	2.000	1.11	346.29	425.11	2.17	.07	750.00	509.18	25.13	30.00
	2.000	1.26	407.92	436.12	2.45	.09	1000.00	509.35	26.79	30.00
	2.000	1.54	511.43	440.00	2.90	.13	1500.00	509.63	27.82	30.01
	2.000	1.79	604.57	440.00	3.31	.17	2000.00	509.87	28.29	30.00
	2.000	1.97	682.35	440.00	3.66	.21	2500.00	510.08	30.62	30.00
	2.000	2.15	752.96	440.00	3.98	.25	3000.00	510.28	31.77	30.00
	2.000	2.32	819.18	440.00	4.28	.32	4000.00	510.64	33.75	30.00

SUMMARY OF ERRORS

CAUTION SECNO= 1.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 2 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 3 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 4 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 5 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 6 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 7 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 8 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 9 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=10 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=11 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=12 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=13 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=14 CRITICAL DEPTH ASSUMED

SUMMARY OF PMF AND ONE-HALF PMF ROUTING

```
**********  **********************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 98
**********  **********************

    1     A1                    MISSOURI DAM SAFETY
    2     A2                     BRANNEKY LAKE DAM (MO.31353)
    3     A3                      PMF AND 50 PERCENT PMF
    4     B     300       0         5         0         0         0         0         0         0         0
    5     B1      5
    6     J       1       2         1
    7     J1     .5       1
    8     K         DA BRNKY                                                  1
    9     K1          RUNOFF CALCULATION FOR BRANNEKY LAKE DRAINAGE AREA
   10     M       1       2       .14                 .14         1                                     1
   11     P               25.     100       120       130
   12     T                                                                 -1       -90
   13     W2                     .1
   14     X                               1
   15     K       1BRNKY DM                                                 1
   16     K1        ROUTE HYDROGRAPH THROUGH BRANNEKY LAKE
   17     Y                                           1         1
   18     Y1      1                                                      -506.5       -1
   19     Y4    508     508.2     508.3     508.4     508.6     508.8     508.9      509     509.2     509.4
   20     Y4  509.6     509.9     510.1     510.3     510.6
   21     Y5      0        25        50       100       200       300       400       500       750      1006
   22     Y5   1516      2029      2633      3187      4281
   23     $A      0       2.0       5.5       7.0       8.5      11.0      18.5
   24     $E    490       500       505     506.5       508       510       520
   25     $$  506.5
   26     $D    508
   27     K      99
```

SUMMARY OF DAM SAFETY ANALYSIS

1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	506.50	506.50	508.00
	STORAGE	34.	34.	46.
	OUTFLOW	0.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	509.22	1.22	57.	781.	15.00	15.75	0.00
1.00	509.71	1.71	62.	1711.	17.08	15.67	0.00

PERCENT OF PMF ROUTING
EQUAL TO SPILLWAY CAPACITY

```
********  **********************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********************************
    1                A1                        MISSOURI DAM SAFETY
    2                A2                         BRANNEKY LAKE DAM (MO.51393)
    3                A3                         PERCENT PMF
    4                B     300         9         5         0         3         0         0         0        -4         0
    5                B1      5
    6                J       1         5         1
    7                J1    .05       .06       .07       .08       .09
    8                K         DA BRNKY                                                    1
    9                K1          RUNOFF CALCULATION FOR BRANNEKY LAKE DRAINAGE AREA
   10                M       1         2       .14                 .14         1                                   1
   11                P                25.       100       120       130
   12                T                                                                   -1       -99
   13                W2                .1
   14                X                                   1
   15                K         1BRNKY DM                                                 1
   16                K1          ROUTE HYDROGRAPH THROUGH BRANNEKY LAKE
   17                Y                                                 1         1
   18                Y1      1                                                       -506.5        -1
   19                Y4    503       508.2     508.3     508.4     508.6     508.8     508.9       509     509.2     509.4
   20                Y4  509.6       509.9     510.1     510.3     510.6
   21                Y5      0          25        50       100       200       300       400       500       750      1006
   22                Y5   1516        2029      2633      3187      4281
   23                $A      0         2.0       5.5       7.0       8.5      11.0      18.5
   24                $E    490         500       505     506.5       508       510       520
   25                $$  506.5
   26                $D    508
   27                K      99
```

SUMMARY OF DAM SAFETY ANALYSIS

1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	506.50	506.50	509.00
STORAGE	34.	34.	46.
OUTFLOW	0.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	507.98	0.00	45.	0.	0.00	0.00	0.00
.06	508.09	.09	46.	11.	8.08	18.08	0.00
.07	508.14	.14	47.	17.	9.08	17.50	0.00
.08	508.20	.20	47.	25.	9.33	17.00	0.00
.09	508.29	.29	48.	47.	9.42	16.00	0.00

SUMMARY OF ONE-PERCENT CHANCE FLOOD ROUTING

```
********  **********************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********************************
     1          A1                              MISSOURI DAM SAFETY
     2          A2                               BRANNEKY LAKE DAM (MO.31393)
     3          A3                                100-YEAR STORM (ST. LOUIS DISTRIBUTION)
     4          B    300        0        5        0        0        0        0        0        0        0
     5          B1     5
     6          J      1        1        1
     7          J1     1
     8          K         DA BRNKY                                                          1
     9          K1           RUNOFF CALCULATION FOR BRANNEKY LAKE DRAINAGE AREA
    10          M                    2      .14                .14                                    1
    11          O     288
    12          O1   .007     .007     .007     .007     .007     .007     .007     .007     .007     .007
    13          O1   .007     .007     .007     .007     .007     .007     .007     .007     .007     .007
    14          O1   .007     .007     .007     .007     .007     .007     .007     .007     .007     .007
    15          O1   .007     .007     .007     .007     .007     .007     .007     .007     .007     .007
    16          O1   .007     .007     .007     .007     .007     .007     .007     .007     .007     .007
    17          O1   .007     .007     .007     .007     .007     .007     .007     .007     .007     .007
    18          O1   .007     .007     .007     .007     .007     .007     .007     .007     .007     .007
    19          O1   .007     .007     .012     .012     .012     .012     .012     .012     .012     .012
    20          O1   .012     .012     .012     .012     .012     .012     .012     .012     .012     .012
    21          O1   .012     .012     .012     .012     .012     .012     .012     .012     .012     .012
    22          O1   .012     .012     .012     .012     .012     .012     .012     .012     .023     .023
    23          O1   .023     .023     .023     .023     .023     .023     .023     .023     .023     .023
    24          O1   .023     .023     .023     .023     .023     .023     .030     .030     .030     .030
    25          O1   .030     .030     .048     .048     .048     .049     .049     .049     .134     .134
    26          O1   .134     .255     .255     .546     .817     .380     .255     .134     .134     .134
    27          O1   .049     .049     .049     .048     .048     .048     .030     .030     .030     .030
    28          O1   .030     .030     .023     .023     .023     .023     .023     .023     .023     .023
    29          O1   .023     .023     .023     .023     .023     .023     .023     .023     .023     .023
    30          O1   .012     .012     .012     .012     .012     .012     .012     .012     .012     .012
    31          O1   .012     .012     .012     .012     .012     .012     .012     .012     .012     .012
    32          O1   .012     .012     .012     .012     .012     .012     .012     .012     .012     .012
    33          O1   .012     .012     .012     .012     .012     .012     .007     .007     .007     .007
    34          O1   .007     .007     .007     .007     .007     .007     .007     .007     .007     .007
    35          O1   .007     .007     .007     .007     .007     .007     .007     .007     .007     .007
    36          O1   .007     .007     .007     .007     .007     .007     .007     .007     .007     .007
    37          O1   .007     .007     .007     .007     .007     .007     .007     .007     .007     .007
    38          O1   .007     .007     .007     .007     .007     .007     .007     .007     .007     .007
    39          O1   .007     .007     .007     .007     .007     .007     .007     .007     .007     .007
    40          O1   .007     .007     .007     .007     .007     .007     .007     .007
```

41	T							-1	-78		
42	W2		.1								
43	X			1							
44	K	1BRNKY DM						1			
45	K1	ROUTE HYDROGRAPH THROUGH BRANNEKY LAKE									
46	Y				1	1					
47	Y1	1						-506.5	-1		
48	Y4	508	508.2	508.3	508.4	508.6	508.8	508.9	509	509.2	509.4
49	Y4	509.6	509.9	510.1	510.3	510.6					
50	Y5	0	25	50	100	200	300	400	500	750	1006
51	Y5	1516	2029	2633	3187	4281					
52	$A	0	2.0	5.5	7.0	8.5	11.0	18.5			
53	$E	490	500	505	506.5	508	510	520			
54	$$	506.5									
55	$D	508									
56	K	99									

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	506.50	506.50	509.00
STORAGE	34.	34.	46.
OUTFLOW	0.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	508.53	.53	50.	166.	12.92	12.42	0.00

SUMMARY OF TEN-PERCENT CHANCE FLOOD ROUTING

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***********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  01 APR 80
***********************************
   1        A1                   MISSOURI DAM SAFETY
   2        A2                    BRANNEKY LAKE DAM (MO.31393)
   3        A3                     10-YEAR STORM (ST. LOUIS DISTRIBUTION)
   4        B     300      0      5      0      0      0      0      0      0      0
   5        B1      5
   6        J       1      1      1
   7        J1      1
   8        K        DA BRNKY                                   1
   9        K1         RUNOFF CALCULATION FOR BRANNEKY LAKE DRAINAGE AREA
  10        M              2    .14           .14                               1
  11        0     288
  12        01   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
  13        01   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
  14        01   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
  15        01   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
  16        01   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
  17        01   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
  18        01   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
  19        01   .005   .005   .009   .009   .009   .009   .009   .009   .009   .009
  20        01   .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
  21        01   .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
  22        01   .009   .009   .009   .009   .009   .009   .009   .009   .015   .015
  23        01   .015   .015   .015   .015   .015   .015   .015   .015   .015   .015
  24        01   .015   .015   .015   .015   .015   .015   .028   .028   .028   .028
  25        01   .028   .028   .041   .041   .041   .041   .041   .041   .086   .086
  26        01   .087   .165   .165   .374   .583   .260   .165   .087   .086   .086
  27        01   .041   .041   .041   .041   .041   .041   .028   .028   .028   .028
  28        01   .028   .028   .015   .015   .015   .015   .015   .015   .015   .015
  29        01   .015   .015   .015   .015   .015   .015   .015   .015   .015   .015
  30        01   .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
  31        01   .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
  32        01   .009   .009   .009   .009   .009   .009   .009   .009   .009   .009
  33        01   .009   .009   .009   .009   .009   .009   .005   .005   .005   .005
  34        01   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
  35        01   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
  36        01   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
  37        01   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
  38        01   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
  39        01   .005   .005   .005   .005   .005   .005   .005   .005   .005   .005
  40        01   .005   .005   .005   .005   .005   .005   .005   .005
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•           .1                                              -1      -78
A                  1
A            1BRNKY DM                                              1
A1      .     ROUTE HYDROGRAPH THROUGH BRANNEKY LAKE
Y                                1       1
Y1       1                                           -506.5      -1
Y4     508   508.2   508.3   508.4   508.6   508.8   508.9      509   509.2   509.4
Y4   509.6   509.9   510.1   510.3   510.6
Y5       0      25      50     100     200     300     400      500     750    1006

Y5    1516    2029    2633    3187    4281
$A       0     2.0     5.5     7.0     8.5    11.0    18.5
$E     490     500     505   506.5     508     510     520
$$   506.5
$D     508
K       99
```

SUMMARY OF DAM SAFETY ANALYSIS

1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	506.50	506.50	508.00
STORAGE	34.	34.	46.
OUTFLOW	0.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	508.15	.15	47.	19.	12.42	13.58	0.00


ATE
ME